

REMARKS/ARGUMENTS

Claims 1 to 29 are currently pending in this application. Claims 8 and 14 have been amended, and claims 19 to 29 have been canceled. No new matter has been introduced by the amendments set forth in this response.

Rejections Under 35 U.S.C. §112

The Examiner rejected claim 14 as being indefinite under 35 U.S.C. § 112, second paragraph. Specifically, the Examiner rejected claim 14 as failing to set forth the "size distribution" claimed. Applicants have amended the claim to recite a specific size range, thereby obviating this rejection.

Rejection Under 35 U.S.C. §102(b)/(e)

The Examiner rejected claims 19 to 29 under 35 U.S.C. §102(b)/(e) over either U.S. Patent No. 5,384,203 to Apfel or U.S. Patent No. 7,073,560 to Kang et al. Applicants have amended the application to cancel the subject matter of claims 19 to 29, thereby obviating this rejection.

Rejections Under 35 U.S.C. §103

The Examiner rejected claims 1 to 29 under 35 U.S.C. §103(a), as being unpatentable over Johnson et al. (U.S. Patent No. 7,017,645), or alternatively over Kang et al. in view of Johnson et al.. Applicants respectfully traverse these rejection.

As has been discussed in previous Office action responses, the current claims are directed to a method of forming an amorphous foam in accordance with the following steps:

- Heating the alloy to its liquidus temperature and introducing bubbles into the alloy where the bubbles have a specific internal bubble pressure;
- Cooling the precursor to at least the alloy's glass transition temperature of the alloy; and
- *Expanding* the bubbles in the precursor while the precursor is at a temperature between the nose of the crystallization curve and above the

glass transition temperature of the alloy by providing a pressure gradient to the precursor *where the pressure during the expansion is lower than the internal bubble pressure* of the introduced gas bubbles formed during the precursor forming step. (Italics added for emphasis)

As has also been previously argued the processes described in the prior art foam patents, such as the Patten, Apfel and Kang et al. patents, all differ in a number of significant ways from the process of the current application. The most striking of these differences is the complete lack of any teaching concerning at what temperature the alloy should be held during the bubble formation step. For example, nowhere does Patten ever discuss the importance of the nose of the crystallization curve or glass transition temperature as required by the claims of the current application. Likewise, the Apfel process nowhere describes or even suggests cooling the alloy to a temperature range between the nose of the crystallization curve and the glass transition temperature of the alloy because the Apfel process and the foam created by the process are entirely uncontrollable. Similarly, nowhere do Kang et al. ever discuss the nose of the crystallization curve for such amorphous alloy foams at all.

Moreover, as previously explained this is a critical feature of the invention. For example, Applicants disclose:

The applicants discovered that the sluggish crystallization kinetics [in the thermoplastic zone] (see FIG. 1) can be beneficially exploited to develop novel processing methods for bulk-solidifying amorphous alloy foam structures. Furthermore, the applicants discovered that utilizing these novel processing methods and by accessing a large regime of viscosity values, between ~ 1 Pas and $\sim 10^{13}$ Pas, highly homogeneous and controllable amorphous metallic foam structures can be obtained. Applicants further discovered that these novel methods of processing amorphous

alloys into metallic foam structures can substantially forego or relax the dimensional limitations arising from the critical cooling rate to form an amorphous phase. (Specification, paragraphs 46 & 47.)

In short, nowhere do any of the foam applications ever even discuss the concept of how to regulate the process parameters of foam creation by manipulating temperature and viscosity in the manner discussed by Applicants. In light of these manifest deficiencies the Examiner seeks to include the disclosure of the Johnson et al patent to render obvious by combination the concept of processing amorphous alloy materials in a window between the nose of the crystallization curve and the glass transition temperature of the alloy. Applicants simply cannot agree that the disclosure of Johnson et al. can or would in any way be applied to the problem of foam formation set forth in the current application.

Specifically, the Johnson et al. patent is entirely directed to the process of "shaping" an amorphous alloy into a high-quality defect-free final part. (See, e.g., "Background of Invention", last paragraph.) Nowhere do Johnson et al. ever discuss, teach or even suggest that the shaping process taught therein could be used in conjunction with a foam process, which is inherently a process in which controlled imperfections are not just desired but required. Indeed, Applicants would submit that the Johnson et al. patent teaches an overall process that is simply inapplicable to the formation of foams. Specifically, because the Johnson et al. process is focused on shaping amorphous alloys, and more specifically to creating "defect-free" parts Johnson et al. teach that the pressure applied to the alloy during the pre-quenching step must be kept very low to avoid any to avoid creating any instabilities in the alloy. (See, e.g., col. 14, lines 5 to 45.) More significantly, Johnson et al. teach that the pressure applied to the alloy during this pre-quenching step must be lower than the pressure applied during the shaping process, in some cases by two orders of

magnitude, to ensure that the alloy and the final part remain amorphous and defect free. (See, e.g., Table III and "Summary of Invention" col. 5, lines 29 to 38.) Moreover, the importance of using a low pressure regime when shaping an alloy in the thermoplastic processing window cited by the Examiner and described in the Johnson et al. patent is repeatedly stressed. For example, the authors write in relevant part:

Further, the invention also recognizes that by controlling *the pressure and/or strain-rate profile* at certain temperature ranges, amorphous alloys can be formed and shaped into higher quality articles having much higher aspect-ratios with closer tolerances and far more detailed replication of mold features. In sum, the process allows production of very high quality, precision substantially amorphous net shape components having exceptional soundness, integrity, and mechanical properties.

(Johnson et al., col. 9, line 61 to col. 10, line 1, italics added for emphasis.)

The teachings of Johnson et al. are simply inconsistent with the process and claims of the current application. Specifically, the claims of the current invention require that the pressure applied in the pre-quench stage be higher than the pressure applied to the alloy in the shaping stage. The reason for this contradictory teaching is fundamental to foaming, namely that the process of producing a foam requires an internal shaping force, not an external shaping force as described in the Johnson et al. patent. Applicants would submit that one of skill in the art, having read in the Johnson et al. reference the importance of maintaining the pressure in the initial pre-quenching step at a very low level to ensure laminar flow and avoid the creation of defects, would have not only not been motivated to incorporate that teaching into the foam processes of Patten, Apfel and Kang et al., but would actually have been led away from such an incorporation by the teachings provided in the Johnson et al. patent. More particularly, since foam processing relies on elevated pressures during the quenching phase to allow for the expansion of the bubbles inside the molten alloy, Applicants submit that

one of skill in the art would have rightly concluded that the Johnson et al. teaching was not at all applicable to foam processing.

Accordingly, Applicants would respectfully submit that the current invention simply cannot be considered anticipated or rendered obvious by the disclosures of the cited prior art patents.

Double-Patenting Rejection

Finally, the Examiner also rejected claims 1 to 29 on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1 to 41 of the Kang et al. patent in further view of Johnson et al. Applicants again must respectfully traverse this rejection.

Specifically, in addition to the above comments, which are equally valid here, Applicants would point out that the Examiner is improperly using the disclosure of the Kang et al. patent to reject the current application not the subject matter of the claims of the Kang et al. patent. Under the MPEP (§804) it is made clear that in determining double-patenting the subject matter of the *claims* of the two patents, not the disclosures of the two patents must be considered. For example, the MPEP states in relevant part:

Since the doctrine of double patenting seeks to avoid unjustly extending patent rights at the expense of the public, the focus of any double patenting analysis necessarily is on the claims in the multiple patents or patent applications involved in the analysis.

In the instant case the current invention is directed to a process for forming amorphous alloy foams, while all of the claims of the Kang et al. patent are directed to metallic foams not to methods of forming metallic foams as claimed in the current invention. Indeed, nowhere do any of the claims of the Kang et al. patent include any reference to process parameters, much less to the specific process parameters claimed in the current application. Accordingly, Applicants do not understand how the

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claims of the instant application can be considered "patentably indistinct" over the *claims* of the Kang et al. patent.

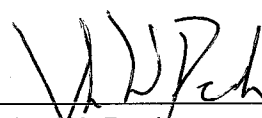
Conclusion

In view of the foregoing amendment and response, it is believed that the application is in condition for further examination. If any questions remain regarding the allowability of the application, Applicant would appreciate if the Examiner would advise the undersigned by telephone.

Respectfully submitted,

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